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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 15.

SOME DESTRUCTIVE POTATO DISEASES:

WHAT THEY ARE AND HOW TO PREVENT THEM.

BY

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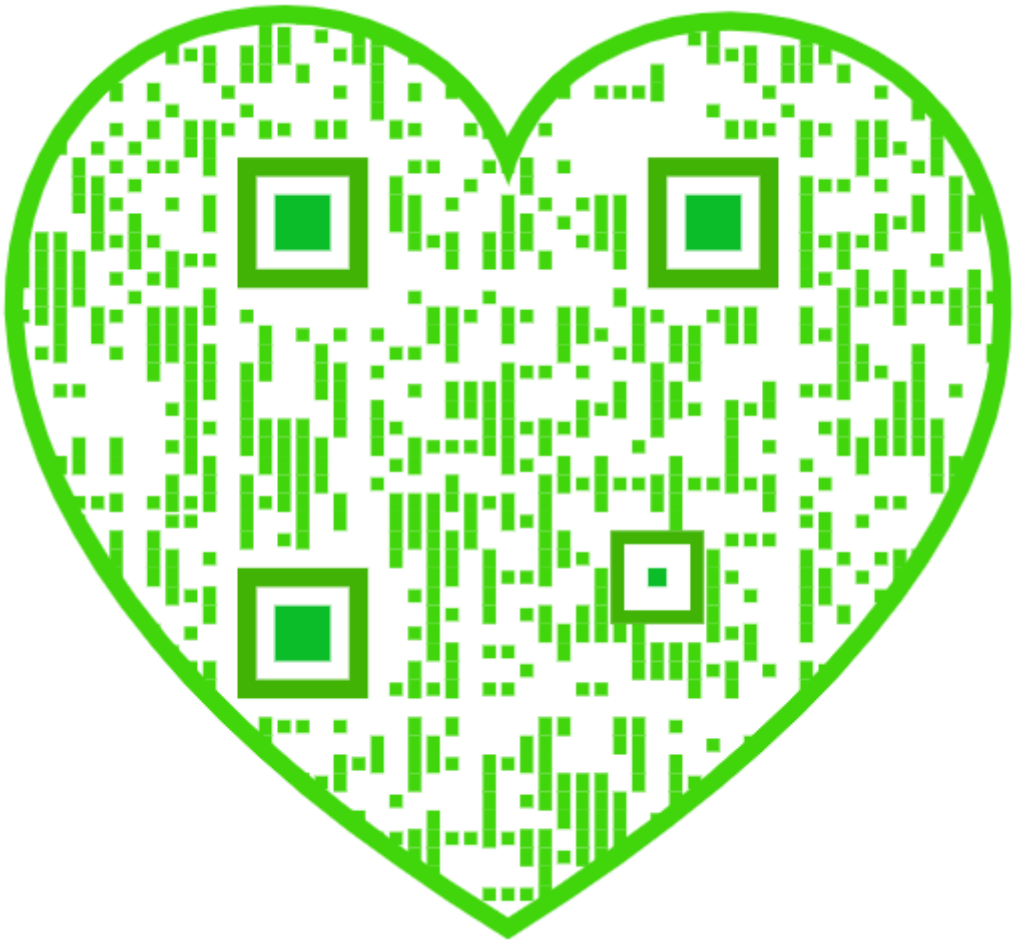

FARMERS' BULLETINS.

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SOME DESTRUCTIVE POTATO DISEASES: WHAT THEY ARE AND HOW TO PREVENT THEM.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF VEGETABLE PATHOLOGY,
Washington, D. C., March 9, 1894.

SIR: I have the honor to submit herewith the manuscript of Farmers' Bulletin No. 15, on some destructive potato diseases and methods of treating the same.

Respectfully,

B. T. GALLOWAY,
Chief of Division of Vegetable Pathology.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

INTRODUCTION.

Among the many fungous diseases affecting the Irish potato, three are especially worthy of consideration, on account of the regularity of their occurrence in the United States and the widespread losses they occasion. The diseases in question are potato blight or downy mildew, the Macrosporium disease, and potato scab. In the accompanying pages are given some of the more important characters, by means of which the several diseases may be distinguished, together with brief directions embodying the latest information in regard to treatment.

HOW THE DISEASES MAY BE DISTINGUISHED.

Potato blight (*Phytophthora infestans*).—This disease attacks the leaves, stems, and tubers. Generally the first noticeable effect upon the leaves is the sudden appearance of brownish or blackish areas, which soon become soft and foul-smelling. So sudden is the appearance of the disease in some cases that fields which one day look green and healthy

may within the next day or two become blackened as though swept by fire. The rapid spread of the disease is dependent in large measure upon certain conditions of moisture and heat. A daily mean or normal temperature of from 72° to 74° F. for any considerable time, accompanied by moist weather, furnishes the best conditions for the spread of the disease. On the other hand, if the daily mean or normal temperature exceeds 77° for a few days the development of the disease is checked. This fact explains why the potato-blight fungus seldom occurs to any serious extent in sections where the mean or normal daily temperature exceeds for any length of time 77°. The tubers

FIG. 1.—Leaf of potato affected with blight (*Phytophthora infestans*).

affected with the disease in question show depressed, dark-colored spots on the surface, while within are seen blotches and streaks of a brownish or blackish color. Other diseases may produce similar effects, so that in this case the changes are not so characteristic as those shown by the leaves.

The Macrosporium potato disease.—From reliable evidence there is every reason to believe that this disease is often more widespread and destructive in this country than the true blight. There is no doubt that the two diseases are often mistaken for the same thing; in fact it has been the custom for many years to attribute nearly all maladies affecting the potato to the blight fungus.

The Macrosporium disease (fig. 2) attacks the leaves and sometimes the stems, but never the tubers. The disease may appear at any time after the plants are from 4 to 6 inches high. At first the older leaves show grayish brown spots, the affected parts becoming hard and brittle. The disease progresses rather slowly, the spots gradually becoming larger, especially along the edges of the leaflets. At the end of ten days

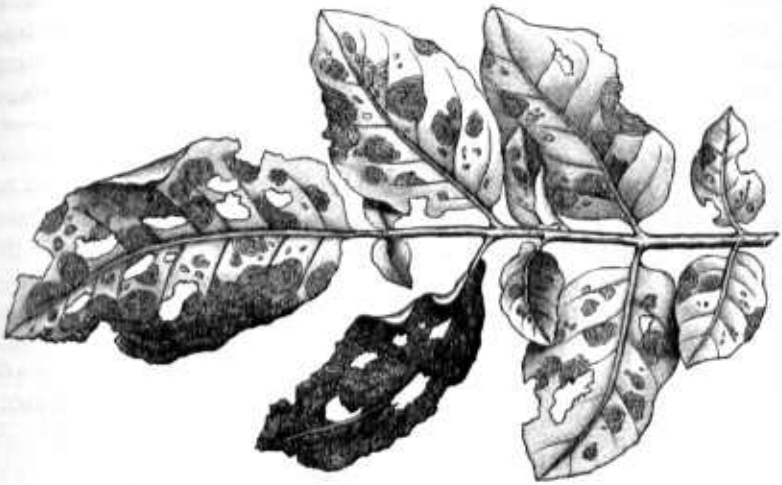

FIG. 2.—Leaf of potato affected with the Macrosporium disease.

or two weeks half of the leaf surface may be brown, withered, and brittle, while the rest is of a pale yellow color. Three weeks or a month may elapse before all the leaves succumb, the stems in the meantime remaining green, until they finally perish through lack of nourishment. The tubers stop growing almost as soon as the leaves are attacked, and as a result the crop is practically worthless.

FIG. 3.—Potato scab.

Potato scab.—Within recent years this disease has attracted a great deal of attention. Its effects on the tuber are so prominent and easily recognized that nothing further on this point need be said (fig. 3).

FUNGICIDES OR PREVENTIVES TO BE USED FOR THE DISEASES.

For blight and the Macrosporium disease nothing so effective as the Bordeaux mixture has been found. This should be prepared as follows: Pour into a 45-gallon barrel about 30 gallons of clean water, then weigh out 6 pounds of bluestone or copper sulphate, and after tying it in a piece of coarse sacking, suspend the package just beneath the surface of the water by means of a string tied to a stick laid across the top of the barrel. In another suitable vessel, such as a tub or half barrel, slack 4 pounds of fresh lime. Slack the lime carefully by pouring on small quantities of water at a time, the object being to obtain a smooth, creamy liquid, free from grit. As soon as the bluestone is dissolved, which will require probably less than an hour, pour the lime milk into the bluestone solution, stirring constantly to effect a thorough mixing; add enough water to fill the barrel, stir again, and the mixture is then ready for use.

For the treatment of potato scab a solution of corrosive sublimate has given the best results. This should be prepared by dissolving 2¼ ounces of corrosive sublimate in about 2 gallons of hot water and after an interval of ten or twelve hours diluting with 13 gallons of water.

WHEN AND HOW TO APPLY THE FUNGICIDES.

For potato blight and the Macrosporium disease, apply the Bordeaux mixture, beginning when the plants are about 6 inches high, and continuing at intervals of twelve or fourteen days, until five or six applications in all have been made. If the season is rainy it would probably be best to make the treatments every ten days, the object being to *keep the plants at all times covered with the fungicide.* By adding 4 ounces of Paris green to each barrel of the Bordeaux mixture the treatments will not only prevent the diseases under consideration, but keep in check the Colorado potato beetle and other insects as well. Before adding the Paris green to the Bordeaux mixture the former should be made into a thin paste by mixing with a small quantity of water.

The success of this work depends in large measure upon the thoroughness with which the fungicides are applied. To reach all parts of the plants above ground with a fine spray requires a good force pump and a suitable nozzle. The knapsack sprayer now on sale in nearly every section of the country will be found one of the most useful machines for spraying fields of 5 acres or less. For larger plantations more powerful machines should be used. A cheap and serviceable apparatus, well suited for this work, may be made by mounting a good, strong force pump on a barrel and then placing the barrel and mounted pump in a light wagon. The entire outfit, including barrel, pump, hose, nozzles, operator, and boy to drive, may be drawn by one horse. As the wagon is drawn slowly between the rows the man in the wagon may

operate the pump, and at the same time keep the mixture stirred, while two others on the ground hold the nozzles and direct the spray over the plants. The nozzle found best suited to the work is the Vermorel; this is now offered for sale by pump manufacturers and dealers in seeds and agricultural implements in various parts of the country. Of course where there are only a few plants to treat simple devices for the application of the fungicide, such as syringes, watering cans, and even old brooms may be used. These makeshifts, however, should be avoided as much as possible, as they not only fail to distribute the mixture uniformly, but are wasteful.

In addition to the line of treatment suggested care must be taken to avoid the use of diseased "seed," and further, the stems and leaves killed by either the blight or Macrosporium disease should be mowed or cut off and burned.

Potato scab has been very successfully prevented by the use of the corrosive sublimate solution already described, very smooth potatoes having been grown from very scabby tubers. The potatoes to be planted are simply immersed in the solution for an hour and a half, then spread out to dry, cut, and planted in the usual manner. A large barrel offers a convenient receptacle for the solution. The potatoes may be placed in a coarse sack and suspended in the liquid, care being taken to wash the tubers before dipping, providing they are very dirty. The corrosive sublimate is very poisonous, therefore it must be used with great care and kept out of the reach of children and animals. *All treated tubers should be planted.*

COST OF THE WORK.

The cost of the work outlined for potato blight and the Macrosporium disease will depend to a considerable extent upon the kind of machinery used and the price paid for labor. With suitable apparatus, such as has been described, and labor estimated at $1.50 per day, potatoes may be sprayed six times for about $6 per acre. This estimate is based upon experiments extending over several years, and includes the cost of chemicals as well as of labor. The cost of treating scab is mainly in the labor involved in dipping and drying the seed and seldom exceeds 15 cents per acre.

CONCLUSIONS.

The three diseases discussed cause a loss in this country of several million dollars annually. It is believed that much of this loss may be prevented by following the suggestions made, but it must be borne in mind that the treatments are preventive, not curative. The importance, therefore, of beginning the work in time can not be too strongly urged. In the case of blight and the Macrosporium disease the question may arise as to the advisability of going to the expense of arranging for work

that may not be necessary on account of the diseases not appearing. In answer to such a question it may be said that there is scarcely a section of the country where one or another of the diseases mentioned does not occur every year. Furthermore, it is a fact well established by experiments that, even if no diseases whatever appear, spraying with the Bordeaux mixture will increase the yield to such an extent as to make the work profitable.